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Mathematical modeling of rheological properties of clays and clay rocks

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Abstract

A mathematical model of the rheological properties of water-saturated clays has been considered. The model is built upon the combination of the theory of filtrational consolidation and the theory of stability of lyophobe colloids, which is based on the concept of disjoining pressure as excess pressure compared to the hydraulic one which is due to surface forces and which acts in water films between clay particles. It is shown that the problem of shrinkage of a clay layer in deformation can be reduced to the known problem of N. N. Verigin. An approximation solution of pressing-out of water from the clay layer has been analyzed. The obtained approximate solution necessarily results in the introduction of the concept of an ultimate shear stress for clays. Special features of the model which are of importance for explaining characteristic features of transport processes in clays (the possibility of abnormally high pressures in subconsolidated clays) have been studied. It is shown that the solutions obtained are in good agreement with the experimental results.